A Survey of the Pale Imperial Hairstreak Butterfly *Jalmenus eubulus* in New South Wales

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ABSTRACT

The Pale Imperial Hairstreak Butterfly *Jalmenus eubulus* is associated with Brigalow *Acacia harpophylla* communities in Queensland. The only previous record from New South Wales (NSW) was in a Travelling Stock Reserve south of Boggabilla in 1977. A two week survey was undertaken around this location in 2013 to determine whether the species still persisted in NSW and, if so, to document the extent of its distribution and its management requirements. The species was found at four of the 37 locations surveyed. These enclosed an area of 47.2 km^2 (extent of occurrence) with 12.5 km^2 of potential Brigalow habitat. The vegetation at capture sites ranged from old growth to dense saplings, but with Brigalow always dominating the canopy. There were many sites with Brigalow vegetation similar to the capture sites, both within and outside the extent of occurrence, where the species was not found. Further surveys are warranted within suitable Brigalow vegetation both within the extent of occurrence and surrounding areas, as well as in a complex of Brigalow vegetation south of Narrabri, to better define the distribution of the butterfly. There are no conservation reserves within the known distribution in NSW and the butterfly's habitat is highly fragmented and subject to many disturbances.

Keywords: Pale imperial hairstreak butterfly, threatened species, distribution, habitat, NSW

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Introduction

The Pale Imperial Hairstreak or Brigalow Butterfly *Jalmenus eubulus* Miskin 1876 (Lepidoptera : Lycaenidae) was recognised as a separate species by Eastwood *et al.* (2008). Prior to that it was considered a subspecies of the Imperial Hairstreak Jalmenus evagoras, despite being originally described as a separate species. Relative to other species in the genus, the biology of these two taxa is superficially similar but their distributions are apparently largely allopatric (Braby 2000). *Jalmenus eubulus* is associated with Brigalow (*Acacia harpophylla*) -dominated forest and woodland stands from central Queensland to northern New South Wales (NSW). In Queensland it does not occur in the western part of the Brigalow Belt where the Brigalow is more shrubby and naturally stunted and eucalypts are co-dominant.

The larvae are monophagous, feeding on Brigalow leaves (Pierce and Nash 1999; Braby 2000). The species is an obligate myrmecophile with larvae attended by small black ants from the *Iridomyrmex* group of species (Eastwood and Fraser 1999; Pierce and Nash 1999; Breitfuss and Hill 2003).

Jalmenus eubulus is classified as vulnerable in Queensland under the *Nature Conservation Act 1992* and as critically endangered in NSW under the *Threatened Species Conservation Act 1995*. In NSW there was previously only one known record from 35 km south of Boggabilla (De Baar 1977). A survey was undertaken to determine if the species is still extant in NSW and, if so, increase our understanding of its ecology and management requirements.

Methods

A survey for the species was undertaken from 11-15 and 22-25 March 2013. In the previous December rainfall had been below average (~70% of mean) and January rainfall had been double to triple the mean (data examined for Croppa Creek and Boggabilla/Goondiwindi stations). Since adult flight occurs two months after heavier rains (Eastwood *et al.* 2008), it was expected that March would be an optimum time for surveying. Searches of transects were undertaken between 8:30 am and 5:30 pm Eastern Standard Time. During these times butterflies were observed to be active and the first transect of the day was not commenced unless butterflies were seen to be active at the start of a transect. Rain occurred on part of the morning of 23 March and searches were not undertaken during this time.

A map of the extant distribution of Brigalow woodland / forest in NSW was prepared and used as a guide to selecting survey sites. Data were collated from the following sources: Eco Logical (2007, 2010) and Peacock *et al.* (2009) (using regional vegetation community 79), Department of Environment and Conservation (2006) (using Broad Vegetation Type 18), Department of Environment and Conservation (2004) (using vegetation type 96), Peasley and Walsh 2001) and Northern Floodplains Regional Planning Committee (2004) (using Brigalow), Hunter (2006ab) (using C1, C2 and C3), Porteners (2006) (using vegetation type 2/3 and 3) and Porteners (2009) (using vegetation type 4).

Searches were undertaken in 37 locations north and mostly east of Narrabri. In the first week two people were involved but only one person in the second week of survey. A meandering search pattern along a transect was used focusing on Brigalow foliage from ground level to 4 metres in height. The maximum height that could be accessed by the butterfly net used to capture specimens was 3.7 m.

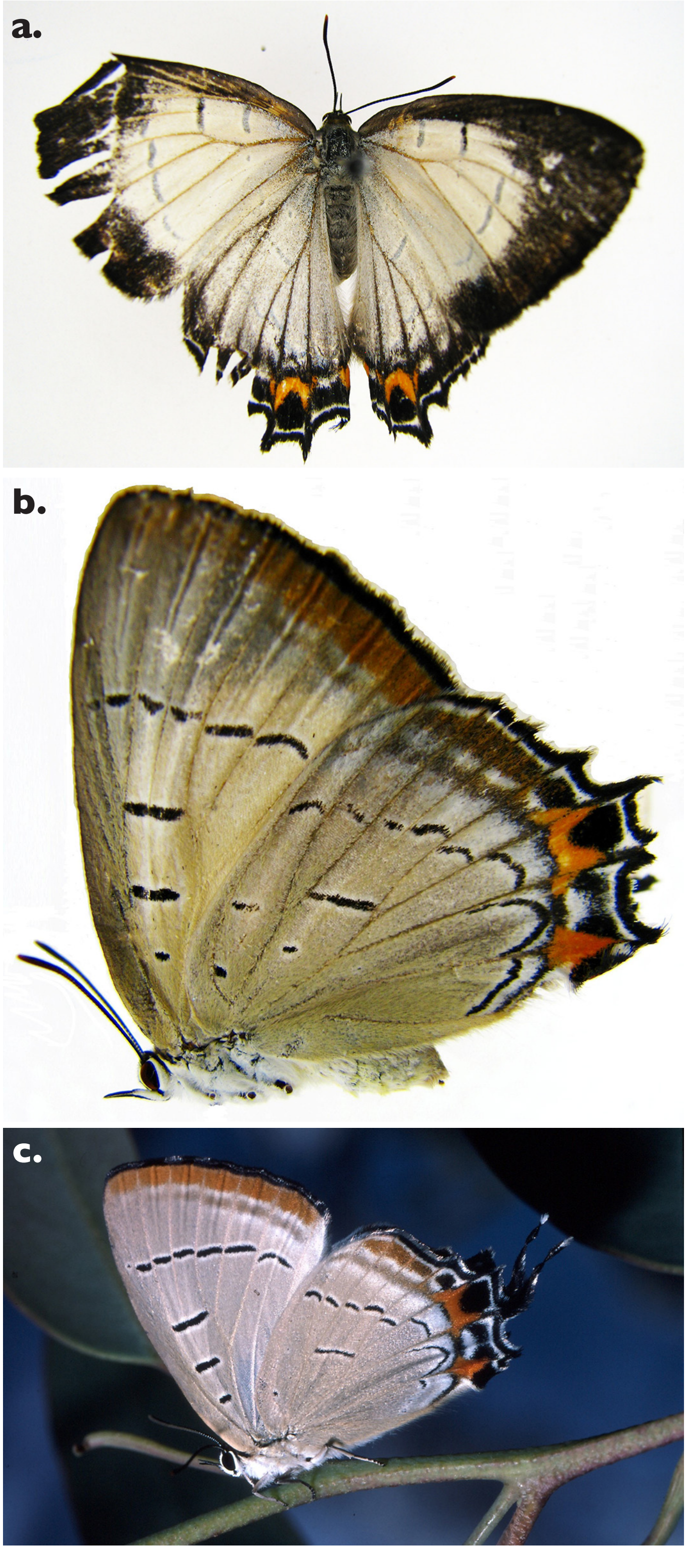

Figure 1. Photo of a *J. eubulus* captured during this study (a = dorsal surface and b = ventral surface) (photo: P. Gillespie) and (c) an individual from Chinchilla Qld (photo: M. Braby). Note the tail on the posterior part of the wing was lost from the specimen shown in a and b.

The width of strips and the area of patches sampled were measured from SPOT imagery in an ArcMap GIS project. Strips are considered to be areas of woodland up to 300 m wide where their length far exceeds the width. In the habitat descriptions (Appendix 1) saplings are considered to be trees taller than three metres with a diameter at breast height (dbh) of less than 12 cm. Old growth trees were considered to be those with a dbh greater than 36 cm. Medium trees were those sized between saplings and old growth trees.

Results

Identification

The *Jalmenus eubulus* butterflies caught in this study (Fig. 1) had broader dark bars on the ventral surface of the wings compared with the figure for this species in Braby (2004). When *J. eubulus* is seen flying from a distance one gets the impression of a lighter grey medium-sized butterfly.

Survey results

Details of the 37 survey locations are provided in Appendix 1. The locations of sites sampled are shown in Figure 2. *Jalmenus eubulus* was captured at four sites (Figure 2):

Site 4: 1 male. (Grid reference (GDA 94 zone 56) 224379E 6802756N)

Site 13: 3 males. Another three individuals were seen but

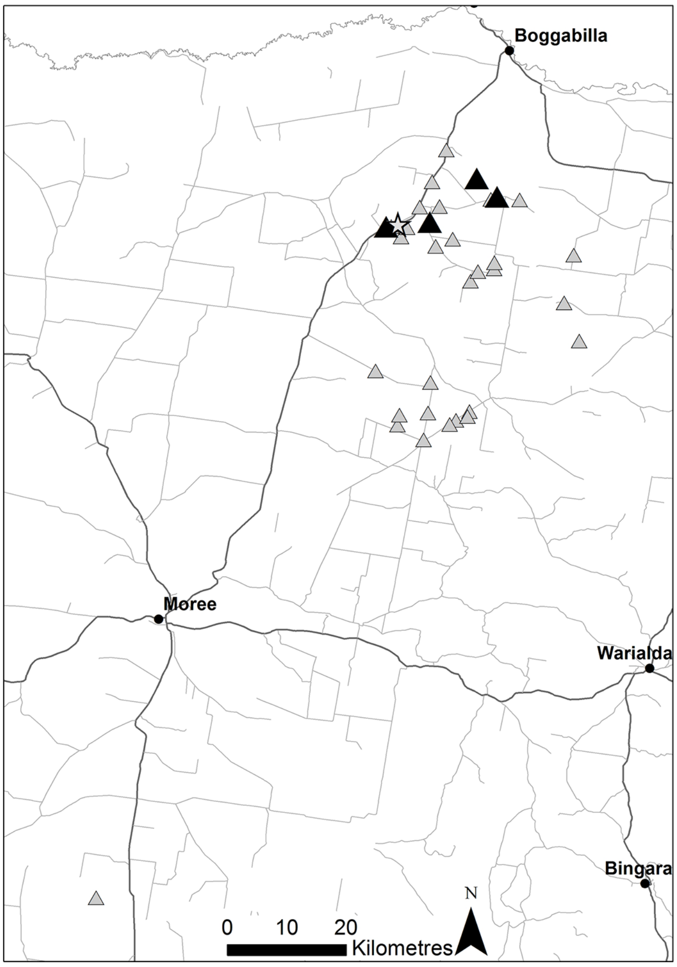

Figure 2. Location of survey sites where *J. eubulus* were captured (black triangles), where they were not found (grey triangles) and the historical location (star).

not captured (Grid Ref. 237665E 6811231N)

Site 14: 1 female. Four more individuals were seen the day after the survey when the site was briefly revisited to take a photo. (Grid Ref. 240563E 6808167N)

Site 27: 1 male. (Grid Ref. 230889E 6803815N).

Habitat

Jalmenus eubulus were only found in areas where Brigalow is a highly dominant canopy species. The species was not found in areas where Belah (*Casuarina cristata*) or Bimble Box (*Eucalyptus populnea*) was the dominant species and Brigalow was sub-dominant. The species was not found in areas where patches of Brigalow were imbedded in a grassland mosaic. The species was found in Brigalow of a range of ages from old growth (see photo of site 14 in Figure 3) to dense saplings (see photo of sites 4 and 27 in Figure 3). Young Brigalow (0.1 to 3 m) or short saplings (< 6 m) were present at all sites where the species was captured. The understorey at sites with butterflies was variable, ranging from bare ground to grassy to shrubby.

Area of Potential Habitat

In order to assess the possible extent of habitat for the species in NSW, mapping of the occurrence of Brigalow communities was collated. Given the lack of the species from western areas of Brigalow in Queensland the vegetation from the far western areas in NSW is not considered to be possible habitat and hence is not shown in Figure 4. This layer is still likely to have errors (both

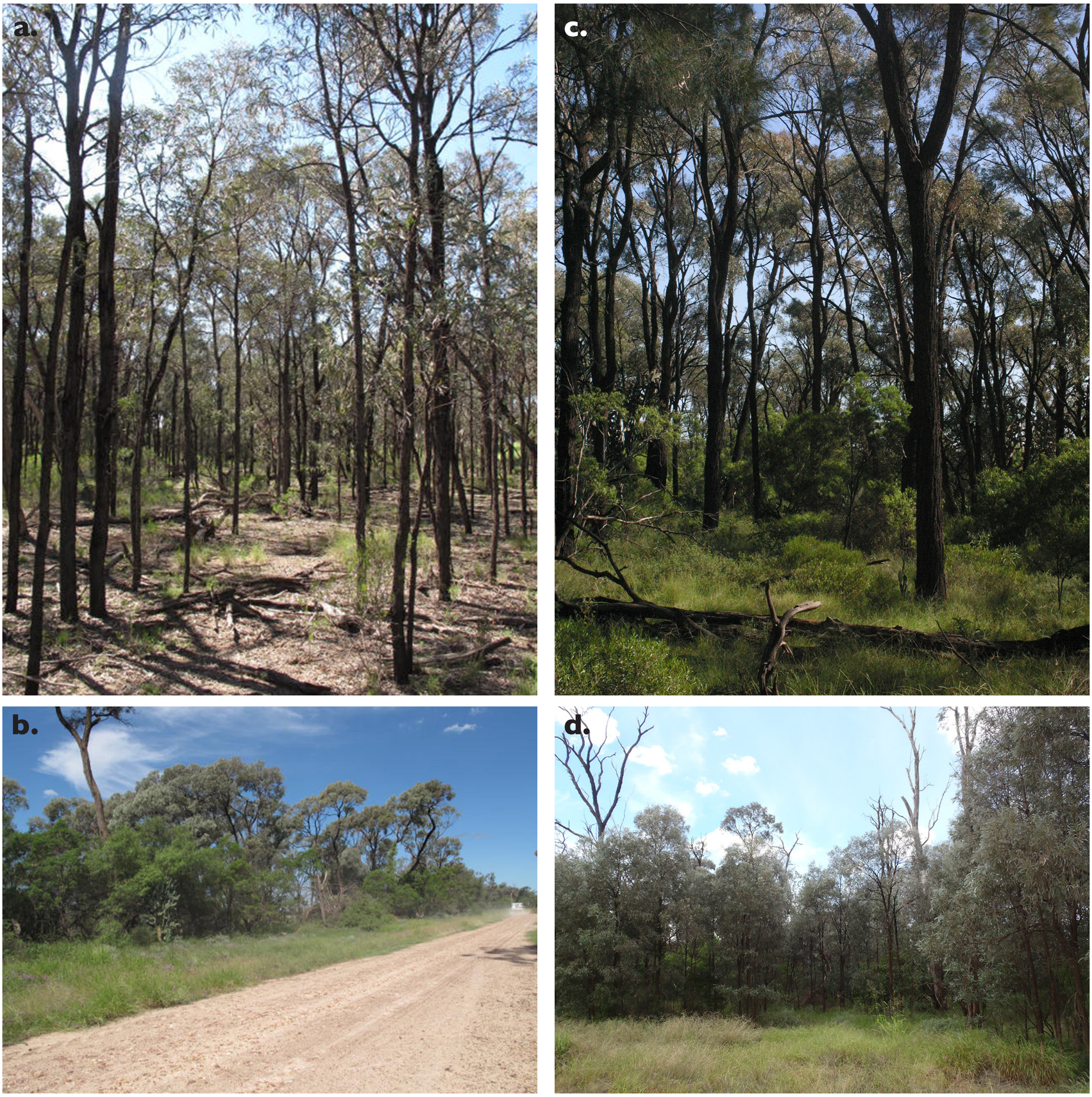

Figure 3. Photos of the sites where *J. eubulus* were captured (a) Site 4; (b) Site 13; (c) Site 14; (d) Site 27.

missing some areas of Brigalow and including areas that are not Brigalow) and contain Brigalow vegetation that is unsuitable for *J. eubulus* (e.g. areas with only Belah that are included in the mapped community Brigalow-Belah Woodland). However, it was used as a rough guide to determining the possible occurrence of habitat.

The extent of occurrence (i.e. the area enclosed by a convex polygon around the known locations) is 47.2 km^2. The area of Brigalow representing potential habitat within the area of occurrence is 12.5 km^2 (= area of occupancy).

Discussion

Jalmenus eubulus was found to still be extant in NSW after a period of 35 years since the last recording of the species in the state. The sites where the species were found were in the general vicinity of the record from 1977. No evidence was found that the species occurred in Brigalow vegetation to the south or east of the extent of occurrence. Even within the envelope of its extent of occurrence, there were sites sampled where the species was not found but the Brigalow vegetation present appeared equivalent to where the species was found. According to Braby (2000) populations of *J. evagoras*, although common, are very localised or patchy in distribution with the location of colonies also being ephemeral. This may be due to the relative scarcity of sites where colonies of the attendant ants occur in combination with suitable larval plants. With *J. evagoras* it has been found that when larvae are absent *Iridomyrmex* workers are not common above ground level, and that their numbers decline in larger trees (Smiley *et al.* 1988). The larvae of *J. evagoras* are usually found on young plants under three metres in height (Smiley *et al.* 1988). Breitfuss and Hill (2003) state that the larvae of *J. eubulus* feed on juvenile Brigalow plants ranging in height up to 5 m. It thus seems that the most suitable larval host plants are those of low height (or at least have foliage close to the ground) so as to promote ease of access to the attendant ants.

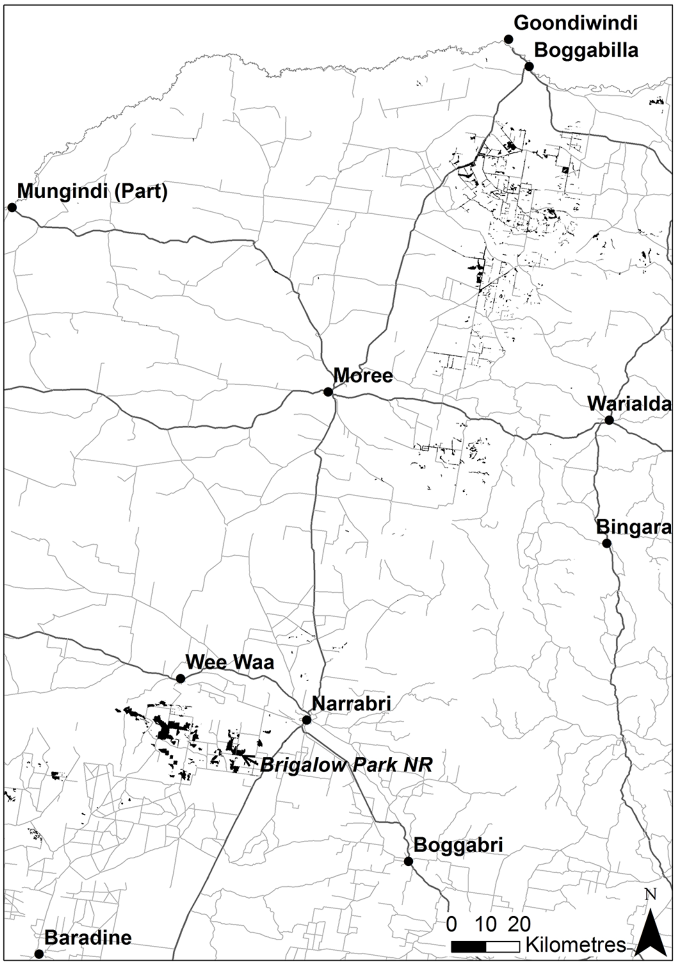

Figure 4. Occurrence of Brigalow vegetation communities (black shading) between Goondiwindi in the north and the Pilliga forest in the south. The location of a reserve with Brigalow vegetation, Brigalow Park Nature Reserve, is shown. The other reserve with Brigalow (Claremont Nature Reserve) is contiguous with and to the north of the Brigalow Park reserve and is part of the same patch of vegetation.

Eastwood *et al.* (2008) state that *J. eubulus* breeds only in old-growth forest, and does not colonise regrowth habitats following clearing or areas that have been disturbed. Given the requirement for short juvenile plants for the larvae this is hard to understand unless it is explained by the habitat preferences of the attendant ants. In this study the occurrence of breeding was not examined but the species was recorded in areas of Brigalow that was not old growth. At two sites having dense stands of saplings to taller young trees only one male was found at each and it is possible that these were dispersing individuals and not indicative of a breeding population. Note that the site photo from Queensland shown in Eastwood *et al.* (2008) (their Fig. 14) has trees that are much smaller than the trees considered to be old growth in this study (see photo of site 14 in Fig. 3).

Brigalow is listed as an endangered ecological community under both the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Threatened Species Conservation Act 1995*. Benson *et al.* (2006) estimate only around 14,000 ha of Brigalow – Belah woodland remain in the Brigalow Belt South Bioregion, less than 10% of the original extent. Extensive clearing of Brigalow for cropping occurred in New South Wales in the 1960s and 1970s (Pulsford 1984).

Jalmenus eubulus is now present in a highly fragmented landscape as a result of this extensive clearing. There are some patches and strips left on private property but much of the remaining habitat is present in Travelling Stock Reserves (TSRs) or road reserves. Of the four sites where the species was found during this survey two were on TSRs (sites 4 and 14), one was on a narrow road reserve (site 27) and the other was in a strip of retained vegetation along a road on private property (site 13). The narrowest of these was 45 m and the widest was 230 m. Around Orange Jalmenus evagoras often prefers to breed in narrow road side vegetation where *Acacia dealbata* seedlings/small plants abound (P. Gillespie, pers. comm. 2013, DPI). It is likely that this fragmentation places the population of the species in NSW at greater risk than would otherwise be the case. It is not known whether the species was once present from a greater area in NSW than at present and was affected by habitat loss and fragmentation to restrict it to its present extent of occurrence but this seems likely.

Grazing of TSRs within the extent of occurrence along the Newell Highway is light and intermittent (Gerald O'Conner, pers. comm. 2013, Livestock Health and Pests Authority). Most properties in the region focus on cropping and thus grazing of remnants on private land is also probably not impacting on *J. eubulus*. However, TSRs along the Newell Highway are impacted by highway maintenance activities (including parking areas for maintenance machinery), development of numerous tracks and powerline clearing.

The Brigalow vegetation in the study area is highly weed infested, most obviously by Prickly Pear *Opuntia stricta*, Tiger Pear *Opuntia aurantiaca* and Mother-of-millions *Kalanchoe tubiflora* but also by grasses. Both pear species are present in sites where Brigalow regeneration is present and at least the former is present at some of the sites where *J. eubulus* were found.

Our lack of understanding of the influence of vegetation conditions on the butterfly or its attendant ant hinders the formulation of recommendations related to habitat management. However, given the ant and larvae occur within five or so metres of the ground it is highly likely that the presence of regrowth is important and needs to be considered in relation to habitat management. Natural regeneration of Brigalow trees is rare with successful seed set events needing to be followed by high summer rainfall (Johnson 1997; Benson *et al.* 2006). On one property sampled (sites 24, 25 and 26) regrowth was common at the time of sampling but had been absent for a long period prior (Tim Heyes, pers. comm., 2013). This was associated with several years of good rains that followed a long drought. Pigs could well impact on regrowth vegetation through their digging activities which may also impact on populations of the attendant ant species.

No secure conservation reserves exist in the extent of occurrence of the species in NSW with recommendations by Pulsford (1984) for reservation of Brigalow vegetation within the range of the butterfly never being acted upon. Travelling Stock Reserves support a significant proportion of the habitat for the known population in NSW. These areas are in public ownership but their continuing status and future management are extremely uncertain due to changing responsibilities within government departments.

Recommendations

Survey

(1). Further survey of suitable areas of Brigalow vegetation both within and surrounding the extent of occurrence should occur with an emphasis of locating breeding colonies.

(2). The best remaining stands of Brigalow that could potentially support the species occur between Narrabri and Pilliga Forest. This includes two conservation reserves with Brigalow (Brigalow Park Nature Reserve and Claremount Nature Reserve). Although this is far south of the known population the suitability of the vegetation and the larger size of the patches here make a survey worth undertaking.

Research

(3). Identify the species of ant that attends the larvae and then undertake a study of the attendant ants to examine their occurrence at different sites and the factors that influence their density and distribution within Brigalow vegetation. This may provide valuable indicators of habitat management required for the butterfly.

(4). If further work indicates breeding occurs at site 14, a monitoring site should be set up to determine the extent of fluctuations in the population and its attendant ants in relation to changes in vegetation condition and climatic factors.

Habitat management

(5). The principal management action should be to increase the amount of habitat and improve its connectivity.

Reservation and habitat protection

(6). Given that much of the habitat within the extent of occurrence and surrounding areas occurs on TSRs and road reserves, consultation with the management authorities of these areas is required to ensure their conservation value is considered.

(7). For any sites on private property where the species is found to breed discussions with the landowners should occur in relation to management and incentive schemes available.

(8). Pulsford (1984) proposed a nature reserve be gazetted either side of the Newell Highway composed of the TSRs around site 4 to protect a sample of the remaining Brigalow vegetation between Boggabri and Moree. This proposal should be re-examined by the Office of Environment and Heritage.

(9). Site 14 was one of two sites where more than one butterfly was observed and is the only one of these on government land (a TSR). Hence it is recommended that confirmation of this area as a breeding site occur and particular focus is paid to the condition, management and protection of the area. It is also recommended that this site be considered for reservation of Brigalow vegetation in the Boggabri to Moree region.

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APPENDIX I

Appendix 1: Details of the sites surveyed and captures of *Jalmenus eubulus* Transect length is shown with x2 when the length of the transect was walked and then repeated walking back to the start. *Jalmenus eubulus* was found at sites 4, 13, 14 and 27. TSR = Travelling Stock Reserve.

Site	Date	Mid-point of transect (GDA 94 zone 56)		Transect length (m)	Survey Time (Hr min)	Landscape	Vegetation / Habitat
		Easting	Northing				
1	11/03/2013	231039	6810636	890 x2	1h 10m	TSR 150 m wide	Brigalow dominant: mainly saplings until the end of transect when medium-sized trees dominant. Belah common.
2	12/03/2013	226456	6803512	2146 x2	1h 50m	TSR 330 m wide	Medium-sized Brigalow with patches of Belah
3	12/03/2013	225186	6803003	2332 x2	2h 10m	TSR 275 m wide	Medium-sized Brigalow with patches of Belah
4	12/03/2013	224580	6802993	1869 x2	2h 10m	TSR from 40 to 255 m wide and 1.29 km long	Mainly abundant sapling Brigalow with open undergrowth, few Belah.
5	13/03/2013	259567	6783549	318	20m	TSR 25 m one side of road & 460 m on the other	Scattered medium sized trees with grassy understorey. Mostly Belah further into patch.
6	13/03/2013	251015	6790832	2590	2h 40m	Road reserve 10 to 15 m wide either side of road	Medium to older Brigalow trees dominant with young regrowth, grassy understorey.
7	13/03/2013	253352	6784462	731 x2	1h 40m	TSR plus adjoining vegetation on private property from 65 m to 330 m wide	Mainly medium-sized & older Brigalow trees. Belah common with grassy open patches also common.
8	13/03/2013	252261	6798716	1861	2h 10m	Road reserve 20 to 60 m wide on one side of the road & 9 m on the other	Mix of medium-sized Brigalow trees and saplings.
9	13/03/2013	244165	6807877	706 x2	1h	TSR 75 m wide on the side of road sampled and 90 m on the other	Dense patches of medium-sized and scattered older Brigalow trees. Belah common.
10	14/03/2013	233040	6815774	1130 x2	2h 10m	TSR 130 m wide	Small patches of medium-sized Brigalow trees with open grassy areas between.
11	14/03/2013	229259	6806308	1019 x2	1h 20m	TSR patch of 218 ha with strips coming off it	Dense patches of sapling to medium-sized Brigalow within a matrix of grassland.
12	14/03/2013	232231	6806539	1364 x2	1h 30m	TSR 87 m wide with track in the middle	Similar to site 12 but older trees present with less Brigalow and more Bimble Box
13	14/03/2013	237569	6811346	578	30m	Strip either side of road (private property, 35 m one side and 45 m on the other. Joins to large patch.	Mix of older and medium Brigalow trees with some young regrowth
14	14/03/2013	240723	6808380	275 x2	55m	TSR 230 m wide but narrower further on	Medium-sized and old tall Brigalow trees, grassy understorey with young regrowth.
15	14/03/2013	239816	6807910	582 x2	40m	TSR 90 m wide	Dense regrowth with scattered medium-sized Brigalow.
16	22/03/2013	184765	6689233	975	30m	TSR 400 m wide	Mostly medium Brigalow with Belah common and grassy/shrubby understorey.

Site	Date	Mid-point of transect (GDA 94 zone 56)		Transect length (m)	Survey Time (Hr min)	Landscape	Vegetation / Habitat
		Easting	Northing				
17	22/03/2013	226235	6762897	110	20m	TSR 38 m wide on one side of road, 25 m wide road reserve on the other side. Road reserve joins a large patch of vegetation.	Mix of ages of Brigalow with Belah common.
18	22/03/2013	227211	6771448	320 x2	35m	Strip 85 m wide	Mix of ages of Brigalow (but no very old trees) with Belah common.
19	22/03/2013	226944	6769743	320 x2	30m	Strip 70 m wide	Mix of ages of Brigalow (including scattered old trees) with Belah common.
20	23/03/2013	238219	6795743	1100	45m	Road reserve 53 m on one side and 35 m on the other.	Mostly medium-sized Brigalow with some Belah.
21	23/03/2013	240641	6796265	646 x2	40m	Strip 50 m wide	Mostly medium-sized Brigalow with Belah common.
22	23/03/2013	240629	6797291	330 x2	25m	Strip 75 m wide	Sapling to medium-sized Brigalow with Belah dominant.
23	23/03/2013	234370	6801087	694	55m	Road reserve 50 m on one side of road and 10 m on the other	Regrowth along disturbed edge and medium-sized Brigalow and some Belah.
24	24/03/2013	226762	6801186	864 x2	1h 10m	Strip 100 m wide, joins to TSR	Medium-sized and older Brigalow with regrowth and some Belah.
25	24/03/2013	226160	6802329	1405 x2	1h 20m	Strip 105 m wide, joins to TSR	Medium-sized and older Brigalow with regrowth and some Belah.
26	24/03/2013	227604	6802841	1042 x2	55m	Strip from 65 to 325 m wide plus large patch	Patches of regrowth and medium-sized Brigalow in a matrix of Belah.
27	24/03/2013	230874	6803902	450 x2	45m	Road reserve 58 m on one side of road and 10 m on the other	Many saplings, some older Brigalow and some Bimble Box.
28	24/03/2013	231877	6799817	990	25m	Road reserve 20 m on one side of road and 13 m on the other	Mainly saplings and some medium-sized Brigalow.
29	24/03/2013	237136	6794104	274 x2	25m	Road reserve and property vegetation 40 m wide	Mainly saplings with scattered medium-sized Brigalow.
30	25/03/2013	237490	6772248	414 x2	55m	130 m wide TSR on one side of road and 30 m road reserve on the other.	Belah dominant. Brigalow are of mixed ages but few old trees.
31	25/03/2013	237230	6771314	1020	50m	15 ha patch linked by a 25 m strip to a wider TSR	Mainly dense sapling Brigalow with some grassy patches present.
32	25/03/2013	235509	6770683	202	15m	50 m wide road reserve linked to a wider TSR	Line of sapling to medium-sized Brigalow with Belah behind.
33	25/03/2013	234592	6770026	373	25m	TSR 160 m wide	Small patches of sapling to medium sized Brigalow in a matrix of grassland.
34	25/03/2013	230871	6767353	557	20m	3.5 ha patch, crown reserve linked to a road reserve and across road from a larger patch	Tall sapling to medium-sized Brigalow with Belah common.
35	25/03/2013	231389	6771916	1570	1h 5m	Road reserve and associated property vegetation. 70 m and 24 m either side of road	Tall sapling Brigalow.
36	25/03/2013	231616	6777011	812	20m	Road reserve 65 and 47 m wide on either side of road	Belah dominant with Brigalow all saplings.
37	25/03/2013	223482	6778714	426	30m	Road reserve 70 and 35 m wide on either side of road	Belah dominant with Brigalow a mix of saplings and medium-sized trees.